

Curbside Consult

Should people stretch before exercise?

Clinicians are under increasing pressure to base their treatment of patients on research findings—that is, to practice evidence-based medicine.¹ Although some authors argue that only research from randomized clinical trials (RCTs) of humans should be used to determine clinical management,² an alternative is to consider the study design (eg, RCT, cohort, basic science) as one of many variables, and that no evidence should be discarded *a priori*. The careful interpretation of all evidence is, and has always been, the real art of medicine.³ In this discussion, these concepts are explored using the sport medicine example of promoting stretching before exercise to prevent injury. A previous critical review of both clinical and basic science literature suggested that such stretching would not prevent injury.⁴ This conclusion was subsequently supported by a large RCT published 5 months later.⁵ Had the review relied only on previous RCT data, or even RCT and cohort data, the conclusions would likely have been the opposite—and incorrect.

Was there ever any evidence to suggest that stretching before exercise prevents injury? In 1983, Ekstrand et al⁶ found that a group of elite soccer teams randomly selected for an intervention of warming up and stretching before exercise; using leg guards and special shoes; taping ankles; and undergoing controlled rehabilitation, education, and close supervision had 75% fewer injuries than the control group. One other RCT and a quasi-experimental study also supported this conclusion,^{7,8} and in both studies, at least warming up was a co-intervention.

Clinical evidence suggesting that stretching before exercise does not prevent injuries has also been reported. van Mechelen et al⁹ conducted an RCT and concluded that the intervention had no effect, although many participants were noncompliant. Looking at “less strong evidence,” results of cohort studies by Walter et al¹⁰ and Macera et al¹¹ sug-



Evidence shows that stretching before exercise may not prevent Former President Clinton from sustaining muscle injury during exercise

gested that stretching before exercise was not beneficial, and authors of several cross-sectional studies reported similar findings.^{12,13} There were significant limitations to all of these studies.

In summary, the RCTs could easily be interpreted to suggest a probable effect using strict evidence-based medicine guidelines. The use of cohort studies may weaken the conclusion, but would be unlikely to reverse it. Understanding the basic scientific research places this clinical evidence in perspective and explains results that may appear contradictory.

First, some people believe that a compliant muscle is less likely to be injured. From the basic science research, we find that an increase in tissue compliance due to temperature,¹⁴ immobilization,¹⁵ or fatigue^{16,17} is associated with a decreased ability to absorb energy. Although increased compliance is not the equivalent of stretching, no basic science research shows that an increase in compliance is associated with a greater ability to absorb energy. Second, most injuries are believed to occur during eccentric

contractions,¹⁸ which can cause damage within the normal range of motion because of heterogeneity of sarcomere lengths.¹⁹⁻²² If injuries usually occur within the normal range of motion, why would an increased range of motion prevent injuries? Third, even mild stretching can cause damage at the cytoskeletal level.²³ Fourth, stretching somehow increases tolerance to pain—that is, it has an analgesic effect.²⁴⁻²⁶ It does not seem prudent to decrease one's tolerance to pain, possibly create some damage at the cytoskeletal level, and then exercise this damaged anesthetized muscle. Of note, no basic science evidence suggests that stretching would decrease injuries. Finally, some basic science data suggest that a warmup may help to prevent injuries.²⁷

A review of these principles helps to explain the apparent contradiction in the clinical literature. Reexamining the RCTs that support stretching before exercise reveals that all of them included at least 1 other effective co-intervention—for example, warmup, leg guards, etc.⁶⁻⁸ Therefore, it is not surprising that fewer injuries were recorded in

the intervention group. On the other hand, the cohort studies^{10,11} and the RCT by van Mechelen et al⁹ controlled for these co-interventions in the analysis stage. Therefore, although formally of a “weaker design,” the studies suggesting that stretching before exercise is not beneficial should be weighted as stronger because the analysis was more appropriate.

In conclusion, the strength of any literature review can be gauged by its ability to predict what future research studies eventually show. The inclusion of all the evidence available on stretching before exercise led to a conclusion that was supported by a subsequent, well-conducted, large RCT. Had the evidence in the review article⁴ been limited to only RCTs, as proposed by some authors, the conclusion would have probably been different and inaccurate.

Much of medicine in general, and sport medicine in particular, is based on historical precedent. When historical precedents are based solely on hypotheses that have more recently been proved incorrect, clinicians must choose to continue treatment on the basis of a known incorrect idea of pathophysiology or change to a treatment based on current knowledge of pathophysiology and pathobiology. The potential side effects of any new treatment (likely to be unknown) must also be weighed against the potential side effects of the historical treatment (more likely to be known). The art, and even science, of medicine then becomes the ability to weigh all the available information at hand without discriminating a priori, and to be able to judge which is most appropriate for the patient.

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